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NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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SITE PREPARATION FOR JACK PINE ON GRAYLING SANDS

ABSTRACT. — Limited seed supply and inadequate mineral soil exposure were the principal reasons that a cutover jack pine stand on Grayling sand did not regenerate after prescribed burning. Two years after a similar stand was burned only 30 percent of the part that received no supplemental treatment had 4,000 seedlings per acre or more. Areas that were scarified with no supplemental seeding, and other areas that were seeded with no scarification, were both 70 percent stocked with 4,000 seedlings per acre; areas that were both scarified and seeded were 84 to 98 percent stocked at this rate. Scarification with an Athens disk was more effective than scarification with a field cultivator.

OXFORD: 231.322:174.7 *Pinus banksiana*:**231.331:232.33(774). KEY WORDS: regeneration, direct seeding, scarification.**

Most jack pine stands have developed after fire, yet prescribed burning has not been consistently effective in regenerating cutover stands (Chrosciewicz 1959, Beaufait 1960, Jameson 1961). Nevertheless, its apparent economic advantage has prompted repeated trials. One of these was the celebrated "popcone burn" on the Kirtland's Warbler Management unit in Oscoda County, Michigan. Some of the factors that could have limited the success of these trials were studied when another part of the 4,000-acre tract was burned.

METHODS

The study was carried out on an area of deep, coarse-textured Grayling sand with a level to gently rolling surface. Thirteen cords of pulpwood per acre had been cut leaving 84 trees per acre, including selected seed trees and many that were too small to be merchantable.

The cutover area was burned at the end of the first growing season after cutting. Two weeks after it was burned sample strips were scarified, some with a field cultivator, which exposed small, shallow patches of mineral soil; other strips were scarified with an Athens disk, which made flat-bottomed trenches up to 8 inches deep and ridges of loose soil. Strips were disked both north-south and east-west because it seemed possible that microclimate might be influenced by orientation of trenches and ridges.

Jack pine seed was sown at the rate of 20,000 viable seeds per acre on part of each scarified strip and the adjacent undisturbed ground. Untreated seed was used in half of the strips and seed treated with a fungicide and a repellent on the others.

Ten permanent plots 1.65 by 13.20 feet were established along the seeded portion of each strip and along an unseeded portion of two east-west disked strips. Seedling counts were made on these plots and a stocked quadrat survey was made of the area that was neither scarified nor seeded. Height, dry weight, stem diameter, and shoot/root ratio were measured on 25 3-year-old seedlings in the Athens disk furrows and 25 comparable seedlings on adjacent undisturbed ground.

RESULTS

Two growing seasons after it was burned, only 30 percent of the unscarified and unseeded area was stocked with the minimum density of 4,000 seedlings per acre (fig. 1). Scarification alone more than doubled the area stocked at the same minimum density. Supplemental seeding alone increased the number of seedlings more than scarification alone, but stocking percentage was nearly the same for these two treatments.

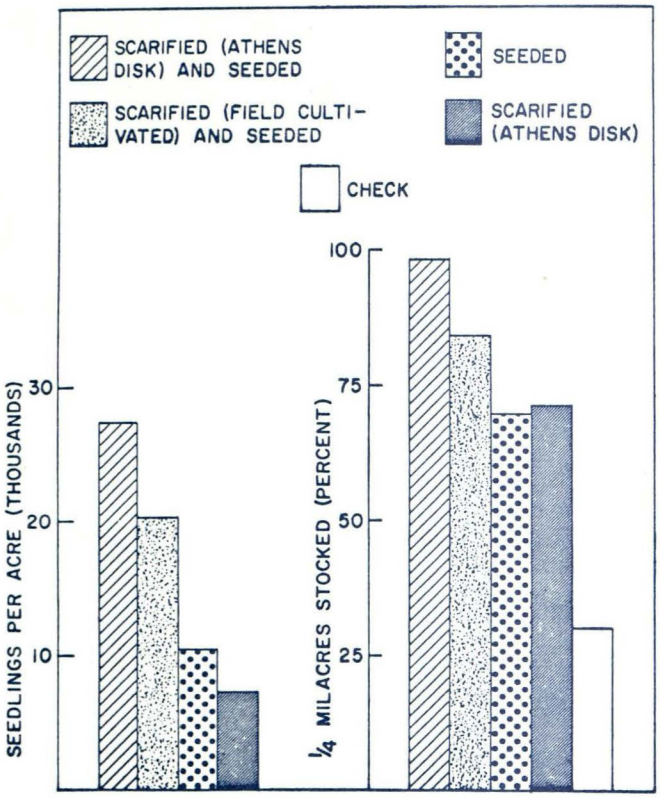

Figure 1. — *Number of seedlings and percent of ¼ milacres stocked, by treatment, at end of the record growing season.*

Scarification with the field cultivator combined with supplemental seeding more than doubled the number of seedlings and increased stocking by about 15 percent. Scarification with the Athens disk was even more effective. There were 27,000 seedlings per acre where seed was sown after disking compared with 20,000 where the field cultivator was used; 98 percent of the disked area had at least 4,000 seedlings per acre compared with 84 percent for the area scarified with the field cultivator (fig. 1).

Disking also seemed to improve growth. Seedlings in the furrows averaged 63 percent taller than those on adjacent undisturbed ground, their stems were 56 percent larger in diameter, and their dry weight was more than three times as great:

	In furrow	*Beside furrow*
Average height, cm.	50	31
Stem diameter, cm.	0.78	0.50
Dry weight, grams	27	8
Shoot/Root Ratio		
Length	1.37	1.07
Weight	5.67	5.12

Seed treatment and disking direction had no measurable effect on seedling establishment or survival.

DISCUSSION AND CONCLUSIONS

In a study of factors influencing regeneration of jack pine in Minnesota, Benzie (1968) found that both adequate seed supply and mineral soil exposure were essential. Because it has also been shown that seed supply is sometimes not adequate after a clearcut stand has been burned (Eyre and LeBarron 1944, Jameson 1961) and that burning sometimes fails to improve seedbeds (Chrosciewicz 1959), it is not surprising that scarification and supplemental seeding increased seedling establishment on this study area. Under favorable moisture conditions, adequate regeneration may develop after prescribed burning despite limited seed supply and unfavorable seedbeds. But on dry soils, such as Grayling sands, scarification and direct seeding will greatly increase the probability that cutover stands will regenerate satisfactorily.

Deep scarification, such as that achieved with an Athens disk, is more effective than removing only small patches of surface organic material. The firm soil at the bottom of the furrows left by the disk probably collects more moisture and retains it longer than loose soil at the general ground level. The disk also removes leached soil near the surface exposing the zone of nutrient accumulation. And finally, this favorable seedbed is in the middle of a strip that is wide enough to check reinvasion by competing vegetation until seedlings are well established.

In contrast, the field cultivator exposes small patches of mineral soil that are reinvaded before seedlings are well established. There are no depressions to collect moisture and the exposed soil is so loose that it does not retain moisture.

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